WHAT WE CLAIM IS:

1. An apparatus for performing parallel, independently controlled molecular reactions, comprising:

(a) a supporting substrate comprising a ceramic layer,

(b) a plurality of separate well structures comprising a thermal conducting layer and wherein the well structures are separated by a thermal insulating layer,

(c) a means for heating each well structure in thermal contact with the thermal conducting layer comprising each well,

(d) a means for cooling each well structure in thermal contact with the thermal conducting layer comprising each well, and

(e) a means for monitoring the temperature of the contents of each well structure in thermal contact with the thermal conducting layer comprising each well.

2. The apparatus of Claim 1, wherein the molecular reaction is polymerase chain reaction.

3. The apparatus of Claim 1, wherein the supporting substrate is made of a thermal insulating material.

4. The apparatus of Claim 3, wherein the thermal insulating material is glass, silicon, plastic, or ceramic.

5. The apparatus of Claim 1, wherein the thermal insulating material is fabricated using ceramic multilayer technology.

6. The apparatus of Claim 1, wherein the thermal conducting layer of the well structures contain a resistive heater.

7. The apparatus of Claim 6, wherein the well structures are made of a thermal conducting material and are separated by a thermal insulating material.

8. The apparatus of Claim 7, wherein the thermal insulating material is glass, silicon, plastic, or ceramic.

9. The apparatus of Claim 7, wherein the thermal insulating material is fabricated using ceramic multilayer technology.

10. The apparatus of Claim 6, wherein the thermal conducting material is undoped silicon, modified plastics, silver, silver palladium, copper, nickel-molybdenum, platinum, or gold and the thermal insulating material is glass, silicon, plastic, ceramic, or air contained in an air channel positioned proximal to the well structure.

11. The apparatus of Claim 1, wherein the well structures are coated with a compound that enhances biocompatibility between the components of the molecular reaction and the thermal insulating or conducting material comprising the well structures.

12. The apparatus of Claim 11, wherein the compound coating is parylene.

13. The apparatus of Claim 1, wherein the means for heating each well structure is an integrated heating system.

14. The apparatus of Claim 13, wherein the integrated heating system is a thin film resistive heater.

15. The apparatus of Claim 13, wherein the integrated heating system is a metal wire resistive heater.

16. The apparatus of Claim 15, wherein the metal wire resistive heater is integrated into the thermal insulating material comprising the supporting substrate.

17. The apparatus of Claim 13, wherein the integrated heating system utilizes column-and-row electrical addressing.

18. The apparatus of Claim 13, wherein the integrated heating system utilizes individual electrical addressing.

19. The apparatus of Claim 1, wherein the means for cooling each well structure is a passive cooling system.

20. The apparatus of Claim 1, wherein the means for cooling each well structure is an active cooling system.

21. The apparatus of Claim 20, wherein the active cooling system is an integrated cooling system.

22. The apparatus of Claim 21, wherein the integrated cooling system comprises a metal plate, and array of metal discs, or a thermo-electric cooler, wherein the integrated cooling system is in thermal contact with each of the well structures.

23. The apparatus of Claim 1, wherein the means for monitoring the temperature of the molecular reactions in each well structure is an integrated optical or electrochemical sensor system.

24. The apparatus of Claim 1, further comprising a means for delivering reagents into each well structure.

25. The apparatus of Claim 23, wherein the means for delivering reagents into each well structure is a microfluidic reagent distribution system.

26. The apparatus of Claim 1, further comprising sealed well structures.

27. The apparatus of Claim 26, wherein the well structures are sealed using a layer of mineral oil.

28. The apparatus of Claim 26, wherein the well structures are sealed using a cover.

29. The apparatus of Claim 28, wherein the cover further comprises a means for heating the well structures.

30. The apparatus of Claim 28, wherein the means for heating the well structures is an integrated heating system.

31. The apparatus of Claim 4, wherein the thermal insulating material is plastic and the means for monitoring the temperature of the contents of each well structure is an integrated resistive thermal detector which can be molded into the plastic.

32. The apparatus of Claim 4, wherein the thermal insulating material is plastic and the means for monitoring the temperature of the contents of each well structure is an thermocouple which can be molded into the plastic.